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CHAPTER 3

WATER SYSTEM

3.00.00 INTRODUCTION

All water distribution systems constructed within the City of Delta shall comply with the requirements of these STANDARDS AND SPECIFICATIONS and may include special criteria established by the City for overall hydraulics of the water utility system. All work performed according to this section must comply with the general requirements contained within Chapter 1 and the acceptance requirements of Chapter 10. Special criteria shall be outlined at pre-design meetings, as determined necessary by the City.

In the case of water mains larger than 12 inches, the owner or his representative shall submit construction specifications to the City for review and approval prior to the City's approval for construction.

3.01.00 INTERRUPTION OF SERVICE

The City's Water Utility Department will operate all existing valves, hydrants, blow-offs and curb stops. NO VALVE OR OTHER CONTROL DEVICE ON THE EXISTING PUBLIC SYSTEM WILL BE OPERATED FOR ANY PURPOSE BY ANYONE OTHER THAN THE CITY. Twenty-four hours prior to the interruption of service, the Responsible Party shall notify all users whose service will be interrupted in order for them to make provisions for necessary water storage. For water mains servicing commercial areas (i.e., restaurants) 48 hours prior notice shall be given, and work affecting the shutdown shall only be performed between the hours of 1:00 a.m. and 5:00 a.m. No line in service will be shutdown for more than a four-hour period at one time. Prior approval by the City is required for all shutdowns.

3.02.00 WATER BREAKS

If notification prior to shutdown is impossible, the Responsible Party shall notify all users within one hour after the shutdown. Since prior notification was not possible, it will be the responsibility of the Responsible Party to supply potable water to the users affected. The Responsible Party shall also contact the City's Utilities Department and Fire Department in reference to this emergency shutdown within one hour.

3.10.00 DESIGN CRITERIA

3.11.00 SCOPE

It is the intent of this "design criteria" section to provide sufficient detailed information to enable the Engineer for the Responsible Party to correctly and efficiently design the overall water system for a particular development. If the City deems it appropriate to require the engineered design of a water system, criteria shall be made available to the Engineer to provide a design acceptable to the City. Any deviation from these STANDARDS AND SPECIFICATIONS must be approved in writing by the City.

3.12.00 GENERAL

The water system shall be designed by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The design process includes the submittal of construction drawings for review and approval by the City.

These construction drawings shall include the following information:

- (A) The area which could be served by the new water line shown on a topographic map, 5 foot contour minimum.
- (B) The following additional information:
 - Lots and blocks to be served and the location of water mains with reference to property lines.
 - Location of service connections, valves, and hydrants by way of stationing.
 - Location of all proposed and existing easements and/or rights-of-way.
 - Existing and proposed water lines and appurtenances with sizes.
 - All other existing and proposed utilities.

At the completion of the project, the engineer shall provide the City with two (2) sets of wet stamped record drawings containing all the above mentioned information as well as locations of all service stub-outs and shall contain any other revisions to the construction drawings.

3.13.00 DESIGN FLOW

The flows used to design the water system for a particular development vary depending on the type of development. A list of criteria to be used in the preparation of all water system analysis will be provided if the City deems it appropriate for the design of the water system.

3.14.00 WATER SYSTEM DESIGN REPORT

A water system design report shall be submitted to the City according to the format provided by the City.

3.15.00 OPERATING PRESSURES WITHIN THE DISTRIBUTION SYSTEM

Pressure within the distribution system shall be a minimum of 40 pounds per square inch during the maximum hour demand and a maximum of 110 pounds per square inch static pressure at the main. The maximum pressure fluctuation at any location in the distribution system between maximum hour demand and minimum hour demand shall not exceed 30 pounds per square inch.

3.16.00 PRESSURE REGULATING STATIONS

Pressure-reducing valve (PRV) installations are used to control pressure between distribution zones. When main extension plans are submitted for review, the need for a pressure-regulating valve installation shall be determined by the Responsible Party's engineer and shall be based on existing zones and the existing distribution system. Plans shall be submitted as part of the utility study indicating size, type, and location of the PRV installation. All calculations shall be submitted to the City for review. A PRV may be required at the direction of the City.

3.17.00 SIZING OF MAINS

3.17.01 Distribution Mains

All mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area serviced according to the water system design report submitted to the City.

The maximum acceptable headloss for six, eight and twelve-inch mains is two feet per thousand feet of main. The minimum diameter for water mains in residential areas, including cul-de-sacs, shall be 6 inches. All schools, shopping centers, business parks, industrial parks, and high-density residential areas shall be looped with mains at least 8 inches in diameter. All waterlines shall be looped and dead end lines will not be permitted unless approved by the City representative.

Oversizing of mains may be required by the City and any cost involved in the oversizing of mains shall be the responsibility of the City.

3.17.02 Transmission Mains

All transmission mains shall be sized according to these STANDARDS AND SPECIFICATIONS.

3.18.00 SYSTEM LAYOUT

3.18.01 General

All mains shall be installed in dedicated rights-of-way or public easements. Water main installation in easements between single-family residential lots will only be allowed for the purpose of looping a water main at the end of a cul-de-sac. Under no circumstances should waterlines be installed parallel to and directly below any concrete such as sidewalks, curbs, or gutters. Lines shall normally be located 5 feet north or east of street centerline, or 5 feet north or east of a curbed median, unless otherwise approved by the City.

The minimum depth of cover for water mains from the final approved grade of the surface to the top of the water main, shall be 4 feet. Where final grades have not been established, mains shall be installed to a depth great enough to insure 4 feet of cover below the approved future grade. The maximum depth of cover for water mains shall be 6 feet below the final approved grade of the surface unless approved otherwise, in writing, by the City.

Water mains shall be laid a minimum of ten feet horizontally from any existing or proposed utility. Upon written approval by the City, a water main may be laid closer than ten feet to a parallel sewer main if it is laid in a separate trench and if the elevation of the invert of the water main is at least 18 inches above the crown of the sewer main and, in addition, Sections 3.18.02-3.18.07 are met. Water mains shall be designed such that they extend the entire frontage of the property to be served or as approved by the City.

When the water main passes under a highway, railroad, or waterway, there shall be a minimum of five feet of cover and a steel casing shall be installed in accordance with the detail drawing in the Appendix of this chapter. The steel casing shall extend the entire width of the right-of-way or easement of the crossing structure or as directed by the City. In all cases, valves shall be located such that the water main at such crossings can be completely isolated without interruption of any services.

3.18.02 Waterline Crossing Over A Sanitary Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer the sanitary sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with AWWA C900 may be used.

3.18.03 Waterline Crossing Over A Storm Sewer Line

When there is less than 18 inches of vertical clearance between the water main and the storm sewer each joint of the storm sewer within ten (10) feet of the centerline of the crossing shall be encased in concrete.

3.18.04 Sanitary Sewer Line Crossing Over A Waterline

When there is less than 18 inches of vertical clearance between the water main and the sanitary sewer the sanitary sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing or polyvinyl chloride pressure pipe in accordance with AWWA C900 may be used.

3.18.05 Storm Sewer Line Crossing Over A Waterline

When there is less than 18 inches of vertical clearance between the water main and the storm sewer the joints of the storm sewer shall be encased in concrete a minimum of ten (10) feet on each side of the centerline of the crossing.

3.18.06 Waterline Crossing Over A Waterline

When there is less than 18 inches of vertical clearance, both waterlines shall be polyvinyl chloride pressure pipe in accordance with AWWA C900 or ductile iron pipe.

3.18.07 Limits On Vertical Separation

Under no circumstances shall the vertical clearance between any lines involving a waterline, sanitary sewerline, or storm sewer be less than 12 inches without written approval from the City.

3.19.00 EASEMENTS

All water mains not in public right-of way shall be in an easement that has a width of at least two times the depth to the pipe invert. The minimum easement shall be 20 feet. Site-specific circumstances may dictate the need for wider easements. The centerline of the main shall be located a minimum of 10 feet from and parallel to the edge of the easement. Meters and fire hydrants not installed within the right-of-way will require an easement dedication ten feet wide and extending three feet behind the meter or fire hydrant. If the meter or fire hydrant easement is longer than ten feet, then the width of the easement shall be a minimum of 20 feet. The fire hydrant shall be centered in such easements. Neither landscaping (except grass, shrubs, trees, private irrigation systems, etc.) nor permanent structures (sheds, buildings, etc.) shall be placed in the easement.

The easement agreement, provided by the City, shall state that any temporary structures (including paving and fencing) placed in the easement shall be removed and replaced by the owner of the land, at their expense, when requested by the City so that maintenance can be performed. The owner of the land shall agree to hold the City of Delta harmless for any replacement of structures removed from the easement.

3.20.00 FUTURE CONNECTIONS

A temporary blow-off, in accordance with the detail drawing in the Appendix of this chapter, is required at the end of any water main that terminates and is anticipated to be extended in the future. When a future main extension is anticipated, the main shall be valved so that only one valve will have to be closed when the main is extended. The valve shall be placed in order that no disruption to existing water service will be experienced by any water customers. The valve shall be restrained so when the one valve is closed and the line to be extended is exposed, the valve will not blow off. Restraint shall be made by the use of a mechanical joint anchoring tee (swivel tee), cross, or by installing a minimum of two full lengths of pipe on the extension side of the valve. No service taps shall be allowed on a main that can be extended in the future between the single valve to be closed and the dead end.

3.21.00 SERVICES

Each structure shall be served by a separate service line and meter. No pressure booster facility of any kind shall be allowed on any service line between the public main and the meter. All service line pressure booster facilities shall be privately owned and maintained. Water service lines shall be located a minimum of 10 feet away from all sewer services (measured horizontally).

All service lines ¾-inch through 3-inch shall be Type "K" copper (ASTM B251-60) or alternate as approved by the City, and shall be installed continuous without joints between the corporation stop at the water main and the meter curb stop. Services shall have a minimum of 4 feet of cover and be laid as shown on the detail drawing in the Appendix of this chapter.

Service connections requiring a flow greater than can be delivered through a 2-inch corporation and service line shall be either 3-inch, 4-inch, 6-inch, or 8-inch connections. Service connections (3-inch, 4-inch, 6-inch, or 8-inch) to new lines shall be made with mechanical joint anchoring tees (swivel tees) or reducing mechanical joint anchoring tees (swivel tees) if installed at the time of main line construction. Later connections, if installed, may also be made with tapping sleeves and tapping valves and at the Responsible Party's expense.

3.22.00 TRANSMISSION MAINS

All water mains 12 inches and larger in diameter shall be classified as "transmission mains."

All transmission mains shall have air and vacuum release valves installed at all high points on the line, and on each side of gate valves in accordance with the detail drawing in the Appendix of this chapter.

All transmission mains shall have blow-off assemblies installed at all low points on the line, constructed in accordance with the detail drawing in the Appendix of this chapter.

No service line taps or any taps less than six inches in diameter shall be made to transmission mains. Exceptions to this will be for air and vacuum release valves only.

Valves on transmission mains shall be placed no more than 1,200 feet apart. Where there are connections to transmission mains, all connecting mains shall be valved at the connection. If the connection main is 16 inches or greater in diameter, there shall be a minimum of two valves at a tee connection and three valves at a cross connection.

3.23.00 UNLAWFUL CONNECTIONS

No installation of potable water supply piping or part thereof shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter any portion of such piping from any tank, receptacle, equipment, or plumbing fixture by reason of back siphonage, suction, back pressure, or any other cause, either during normal use and operation or when any such tank receptacle, equipment, or plumbing fixture is flooded, or subject to pressure in excess of the main line operating pressure. No person shall make a connection or allow one to exist between pipes or conduits carrying domestic water supplied by the City and any pipes, conduits, or fixtures containing or carrying water, chemicals, liquids, gases, or any other substances from any other source.

3.24.00 APPURTENANCES

3.24.01 Valves

Residential distribution systems shall be valved to ensure that no more than 1,000 feet of main or 18 residential units and 1 fire hydrant will be out of service in the event of a single water main break. Valve placement shall be such that there are at least two valves at every tee and three valves at every cross.

Valves larger than 12 inches shall be butterfly valves. Main line valves shall be located at a point on the main that is intersected by an extension of the side property line of lots in the subdivision. Valves shall not be located in concrete areas, such as sidewalks, crosspans, aprons, curbs, or gutters, unless approved prior to placement by the City. Valves located on water mains in easements shall be located at the connecting tee, cross, or elbow. Butterfly valve operators shall be located on the north or east side of the water main. Any valve located in a greenbelt area shall have a 6-inch-wide by 6-inch thick concrete collar around the valve box.

3.24.02 Fire Hydrants

The maximum distance, as measured along the centerline of the street, between fire hydrants shall be 500 feet in residential areas and 300 feet in business and other high-value areas unless approved otherwise by the City. The number and location of fire hydrants in a given area shall be approved by the City. In no case shall a hydrant be located closer than 5 feet to obstructions, driveways, etc. The fire hydrant shall be located within the right-of-way or easements created for utility purposes and on the same side of the street as the water main unless otherwise approved by the City. Fences, landscaping, etc., shall in no way hinder the operation of the fire hydrant. In addition, clear distances to the fire hydrant shall be in accordance with Section 3.19.00 of these STANDARDS AND SPECIFICATIONS.

The fire hydrant lateral lines shall be set at 90 degrees to mains. The fire hydrant lateral line shall be no more than 70 feet in length from the main. No horizontal bends or offsets shall be used in fire hydrant lateral lines. Under no circumstances shall any tap be made on a fire hydrant lateral line.

3.24.03 Thrust Blocks

All bends, tees, plugs, dead-ends, wet taps (in certain cases), hydrants, and blow-offs shall be designed and constructed with concrete thrust blocks. If the soil-bearing strength is unknown, the soil-bearing capacity used in design shall be 1,500 pounds/square foot. Refer to the detail drawings in the Appendix of this chapter.

3.24.04 Meters

Public water meter installations inside any buildings are prohibited unless otherwise approved, in writing, by the City. Meters shall be located at property line within easements. The City encourages the installation of a valve shut off on the property owners side of the meter in order to allow for the shut off of water during water break emergencies. Materials for this shut off shall be approved by the City prior to purchase and installation.

All water meters connected to the City of Delta's utility system shall be the property of the City. Under no circumstances shall anyone other than City personnel remove a water meter once the pit or vault has been inspected and approved. No connections shall be made in the meter pit other than those related to the meter and bypass. Sprinkler system connections shall be made downstream from the meter and a minimum of five feet from the meter pit or vault.

For any installation where special or unusual conditions might exist, detailed drawings, accompanied by a letter of explanation, shall be submitted to the City for review and approval.

For any water meter installation over 2 inches in size vaults will be required and shall be installed in conformance to the detail drawings in the Appendix of this chapter.

There shall be no electrical wiring allowed in any water meter pit or vault unless authorized, in writing, by the City.

Inspections of all residential pits and commercial pits or vaults shall be conducted by the City. Locations and details for commercial pits or vaults shall be reviewed and approved by the City.

All meter sizes for residential, commercial or industrial use shall be determined by a professional engineer registered in the State of Colorado and calculations submitted to the City for review and approval.

3.24.05 Fire Protection Service Line

Valves on newly constructed fire lines shall be located on the tee at the main line. The owner shall maintain all private fire lines beginning at but no including this valve. All fire sprinkler taps shall be installed with an approved backflow prevention device as defined by the City Representative. A property requiring a domestic service line and a fire protection service line will have separate taps for each. Refer to the detail drawing in the Appendix of this chapter.

3.24.06 Valve Vaults

All valves larger than 12 inches shall be installed in a vault in accordance with the detail drawings in the Appendix of this chapter. All valve vaults shall be capable of withstanding AASHTO H-20 highway loading. The vault shall also have lift hooks in the roof for valve removal inside the vault.

Vaults shall be made water proof after construction by use of sealants, epoxies or other approved methods. All vaults shall be designed with wall sleeves and link seal and be capable of handling thrusts caused by removing valves. All vent pipes for vaults shall be installed in conformance with the detail drawings in the Appendix of this chapter.

3.24.07 Manholes

Manholes shall be installed on all pressure regulating valves, permanent blow-off installations, and air release valves in accordance with the detail drawing in the Appendix of this chapter.

3.24.08 Backflow Prevention Assemblies

To prevent backflow contamination of the City of Delta's potable water mains, a backflow prevention assembly shall be installed where any condition might exist that would result in a higher pressure downstream of the water meter than exists in the main line that could allow backflow or backsiphonage of polluted or contaminated water or other substances from the water user's system. The assembly shall be placed downstream of the water meter and installed per Colorado Department of Public Health and Environment guidelines to allow for proper operation and easy access for annual testing and maintenance. Criteria listed in the Uniform Plumbing Code and State guidelines will be used to determine the type of assembly required for each installation based on the potential hazards of the intended use. Some typical applications requiring backflow prevention include hospitals, medical and dental clinics, car washes, dry cleaners, mortuaries, manufacturing processes using chemicals, locations with lawn irrigation systems, buildings with fire protection systems, buildings greater than 40 feet high and locations with a service line larger than 4 inches in diameter.

3.25.0

IRRIGATION SYSTEM DESIGN

Irrigation, where desired for a development, may be provided by means of the City potable water supply. The responsible party shall have the system designed by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgement throughout the design process. The design process shall include coordination with the appropriate water supplying company or provider. The design process includes the submittal of construction drawings for review and approval of the City.

In the event that the responsible party elects to provide irrigation from a source other than from the City of Delta potable water supply, the responsible party shall have the system designed by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgement throughout the design process. The design process shall include coordination with the appropriate water supplying company or provider and will require written consent of said company or provider. The design process includes the submittal of construction drawings for review and approval of the City.

In rural areas of the City where irrigation ditches exist, the City requires said ditches to be piped or covered pursuant to the City's subdivision regulations. In that this is not always feasible or practical, the following information is provided to clarify the requirement.

- (A) In all cases, where irrigation ditches are located adjacent to and/or within road right-of-ways, ditches should either be piped, or piping secured, and appropriate easements provided. In cases where irrigation pipelines share easements with any other utility, additional easement width shall be provided to separate from said utilities.
- (B) For large canals where it is unfeasible or unpractical to pipe or cover, fencing shall be required to protect the life, safety, and welfare of the public.
- (C) Piping of irrigation ditches is not required for those properties that are within the A-1

zoning district or where all proposed lots are larger than 1 acre, except as noted in (A) above.

- (D) In all cases, notes on the subdivision plat shall be included outlining maintenance of piped and open ditches. The City shall not be named responsible for said maintenance.

3.30.00 CONSTRUCTION SPECIFICATIONS

3.31.00 EXCAVATION, TRENCHING AND BACKFILLING

Excavation, trenching and backfilling shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

3.32.00 BEDDING

Granular bedding material used shall meet the requirements of Chapter 9 of these STANDARDS AND SPECIFICATIONS. Bedding shall be placed to six inches below the bottom of the pipe and shall be placed around the sides of the pipe and to a minimum of 12 inches above the top of the pipe and in accordance with the detail drawing in the Appendix of this chapter.

3.33.00 PIPELINE INSTALLATION

3.33.01 General

The City shall be notified at least 48 hours in advance of any pipe installation. The Responsible Party shall notify and arrange for all utility locates prior to excavation. No pipes shall be backfilled until they have been inspected and approved by the City. Alignment and grade of the pipe and the location of fittings, valves, and hydrants shall be staked under the supervision of a professional surveyor registered in the State of Colorado.

Proper implements, tools, and facilities shall be provided and used by the Responsible Party for the safe and convenient execution of the work. All pipe fittings, valves, and hydrants shall be carefully lowered into the trench by means of a derrick, ropes, or other suitable tools or equipment to prevent damage to water main materials and protective coatings and linings. Chains or cables shall not be used for handling pipe with protective coatings. Under no circumstances shall water main materials be dropped or dumped into the trench.

All pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the City. All foreign matter or dirt shall be removed from the interior and ends of pipe and accessories before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the Responsible Party shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

3.33.02 Pipe

Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end, the gasket shall be thoroughly cleaned, and, if performing disinfection by tablet method, as described in Section 3.40.03, dry chlorinating tablets providing 65% hypochlorite shall be attached to the top end of the pipe with water-soluble permatex or an adhesive appropriate for potable water. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home by hand with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. After installation of the polyethylene protective wrap, if required, the pipe shall be secured in place by installation of bedding material and backfill, in accordance with Chapter 9 and the detailed drawings in the Appendix of this chapter.

Deflection from a straight line or grade, as required by horizontal or vertical alignments or offsets, shall not exceed the maximum allowable limits set by the manufacturer's specifications. If the alignment requires deflection in excess of the allowable deflection per joint, special bends, or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limits set forth, as approved, in writing, by the City.

All ductile iron pipe fittings and appurtenances shall be protected with minimum 8 mil polyethylene film wrap. Miscellaneous steel or other ferrous pipe for temporary blow-offs, etc., shall be similarly protected. Methods for applying the wrap shall conform to the detail drawing in the Appendix of this chapter.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer's recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the City, will not be permitted for installation.

During the backfilling of all waterline trenches, a 2-inch-wide tape labeled "Waterline Buried Below" shall be placed in the trench backfill 1 foot above at the top of the select fill and directly over the pipe.

In addition to the tape mentioned above, all PVC waterline installations shall include the installation of a single, 14 or 16-gauge, insulated copper tracing wire taped to the top of the pipe. The tracing wire shall be one piece and installed in a continuous run between valves.

3.33.03 Fittings

Pipes shall be connected to valves and fittings by mechanical joints unless specified differently in the approved drawings. For approved slip-on joints, the joint shall be assembled with a ratchet jack or other approved method in a manner that does not cause any damage to the pipe. Both the spigot and bell must be thoroughly clean and free from tar or other coatings and rust.

For mechanical joint pipe, the last 8 inches of the outside of the spigot end of the pipe and the inside of the bell of all fittings and gate valves shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating), and other foreign matter from the joint and then a thin film of gasket lubricant shall be applied. The cast iron gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the bell of the fitting. Gasket lubricant shall be applied to the rubber gasket and placed on the spigot end of the pipe with the thick edge towards the gland.

After the spigot end of the pipe is placed into the bell and fully inserted the gasket shall be pressed into place within the bell so it is even around the entire joint. After the gland is positioned behind the gasket, the Responsible Party shall install all bolts and nuts and tighten them with a torque wrench. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

Jointing shall be done, unless specifically excepted above, in accordance with AWWA Specification C-111 for a mechanical joint for cast iron pressure pipe and fittings.

3.34.00 VALVE AND VALVE BOX INSTALLATIONS

In addition to the jointing requirements mentioned in Section 3.33.03 of these STANDARDS AND SPECIFICATIONS, the additional requirements of this section shall apply. Valves and valve boxes shall be installed where shown on the approved drawings and as directed by the City. Valve boxes shall be firmly supported, centered, and plumbed over the wrench nut of the valve with the box cover at or minus 1/4-inch within the surface of the finished pavement or at such other elevation as may be directed by the City. Extensions to within 4 feet of the finished grade shall be provided for valves installed with more than 4 feet of cover. Earth fill shall be carefully tamped around each valve box to a minimum distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valves shall have the interiors cleaned of all foreign matter before and after installation.

Gear cases shall be tightened and the valve shall be inspected in opened and closed positions to insure that all parts are in working condition prior to installation. The cases shall be supported by bricks or other means to prevent any shock or stress being transmitted to the valve.

3.35.00 THRUST BLOCKS

The Responsible Party shall excavate as required to ensure that the thrust blocks are placed against undisturbed soil and shall form the sides of the thrust block to provide the size and shape required. When it is impossible, because of over excavation or other causes, to pour a thrust block against undisturbed earth, harness rods shall be used to anchor the fittings to the main in addition to the thrust block and as required by the City. After the concrete has been placed and has set, the Responsible Party shall remove all forming materials prior to backfilling around the thrust block. Concrete for the thrust blocks shall comply with provisions set forth in Chapter 7 of these STANDARDS AND SPECIFICATIONS

The blocking shall be placed so that the pipe and fitting joints will be accessible for repair. A bond breaker shall be placed between the fittings and the thrust block. Backfill may be placed over the thrust

blocks once the surface has set sufficiently to resist the weight of the backfill. However, no tamping or compacting shall be allowed above the thrust block for a minimum of 24 hours after placement. Concrete must set a minimum of 48 hours prior to the initial filling of the line.

3.36.00 CONNECTION TO EXISTING MAINS

At locations where connections to existing water mains are to be installed, the Responsible Party shall locate the existing mains, both vertically and horizontally, and shall verify their exact size in advance of the time scheduled for making the connections. The Responsible Party shall notify and schedule the connection with the City.

Prior to connecting to existing water mains, the Responsible Party shall have all men, materials, and equipment ready to connect the fitting to the existing main to keep the shut-off time to a minimum. As soon as possible after making the connections, the Responsible Party shall flush the connection to prevent any contamination of the existing facilities. The Responsible Party shall take every precaution necessary to prevent dirt or debris from entering the main.

3.37.00 FIRE HYDRANT INSTALLATION

Immediately before installation of a hydrant, the following operations shall be performed:

- (A) The hydrant shall be thoroughly inspected for any defects or damage.
- (B) The hydrant interior shall be thoroughly cleaned.
- (C) The hydrant shall be opened and closed as many times as necessary to determine that all parts are in proper working order, valves are seating properly and the drain valve is operating freely.

Hydrants shall be set so that a minimum of 4 feet of cover is provided for the lateral line and the nozzles are a minimum of 18 inches above finished grade. Each hydrant shall be set on a concrete foundation at least 18 inches by 18-inches and 6 inches thick. Each hydrant shall be blocked against the end of the trench with a concrete thrust block. If the trench is unstable then the hydrant shall be mechanically restrained from the tee at the main to the hydrant in addition to the thrust block.

Each hydrant shall have drain holes with a minimum 18-inch-thick layer of 1-1/2-inch (minimum) washed rock beneath them. A sheet of 8-mil polyethylene shall be placed over the washed rock to prevent dirt from filling the rock. All hydrants shall stand plumb and shall be connected to the street main by a minimum 6-inch lateral line. The fire hydrant base shall be adjusted to not more than 3 inches nor less than 2 inches above the approved finished grade. The maximum allowable height of extensions on hydrants is 12 inches. No hydrant lateral shall be installed any deeper than 6 feet from the top of the approved finished grade.

Hydrants shall have a traffic break-away feature in the barrel at the ground line. Depending upon hydrant location, the use of steel posts filled with concrete may be required for protection, as specified by the City. In areas where the hydrant bottom is installed below ground water, a larger area, 2 times, of 1-1/2-inch (minimum) washed rock enclosed with 8-mil polyethylene shall be installed to insure proper drainage. All other requirements shall be as shown on the detail drawing in the Appendix of this chapter.

3.38.00 TAPS

The size of tap and the tapping method for a given type and size of waterline shall be as follows:

Tap sizes shall be approved and/or determined by the City Community Development Department.

Type of Pipe and Size of Tap (Inches)

SIZE OF PIPE (inches)	DUCTILE IRON				PVC			
	3/4"	1"	1-1/2"	2"	3/4"	1"	1-1/2"	2"
1"	TEE	NO	NO	NO	TEE	NO	NO	NO
1 1/4"	S	S	NO	NO	S	S	NO	NO
2"	S	S	S	NO	S	S	S	NO
3"	S	S	S	TEE	S	S	S	TEE
4"	S	S	S	S	S	S	S	S
6"	S	S	S	S	S	S	S	S
8"	S	S	S	S	S	S	S	S
12"	S	S	S	S	S	S	S	S

TEE -- Tee cut to fit main. City must be present when performed.

S -- Tapping saddle required. All saddles shall have the AWWA taper on its threads.

NO -- No tap permitted with or without a saddle. A tee connection may be permitted if specifically authorized by the City.

All existing AC waterlines shall be tapped using a saddle.

All taps into the water main shall be at an angle of not more than 45 degrees from the horizontal, and corporation stops shall be installed.

“Live” or “wet” taps shall be made by the City and the cost associated will be determined by the City Representative. Taps shall not be made on a water main until the City has performed and the main has passed the pressure tests and clear water tests. Care shall be taken to properly install water service lines so that a minimum of 12 inches of slack is in the service line at the main to protect against pull-out. Tapping mains may require digging out bedding material and cutting or removing part of the corrosion protective wrapping. After the taps are made, the wrap shall be repaired or replaced by the Responsible Party to protect both the service line and the main.

Service taps shall have a minimum separation of 24 inches and be no closer than 24 inches to a main line joint.

Water taps 3/4 inch to 2 inch shall be made by the City of Delta’s Utility Department personnel, or their duly authorized representative. On 3/4 inch to 2 inch taps the City will provide the corporation stop. Services 1-1/2 inch and larger shall require curb stop per the detail drawings in the Appendix of this chapter. On 3/4 inch taps the City will also supply the corporation stop, meter, yoke, pit and cover complete. Any saddles required by the preceding table shall be provided by the Responsible Party. On water taps over 2 inch the City will cut a tee to the main line at the expense of the Responsible Party.

3.39.00

METER INSTALLATION

All meter installations not performed by the City shall be in accordance with the detail drawings in the Appendix of this chapter.

No connections shall be made in the meter pit other than those related to the meter and bypass. Sprinkler system connections shall be made no closer than five (5) feet from the meter pit or vault on the downstream side of the meter

All water meters one inch and larger shall be tested by the City before installation. The Responsible Party shall purchase meters from the City's Utilities Department. In addition, the following specific criteria shall apply:

3.39.01 3/4-Inch and 1-Inch Meter Installations

The meter shall be located at property line within rights-of way or within a public easement. At the point where the service line crosses under the curb, if applicable, shall be marked by chiseling a symbol "W" on the curb face.

The dome or meter lid shall be level and 2 inches above the approved final grade. The copper setter shall be a minimum of 10 inches below the inner cover. A variance of more than 4 inches (vertically) in installing the copper setter will not be accepted.

No meters shall be set in streets, sidewalks, or concrete areas without prior approval of the City. Meter pits shall be constructed using 21" diameter corrugated metal sections 52" tall in traffic lanes or if protected from traffic and approved by the City, Sonoco 20" diameter plastic pipe 52" tall may be used.

Final inspections of the meter pit will be made at the time the meter is actually set. The Responsible Party is responsible for any required adjustments to the copper setter or meter lid at that time.

3.39.02 1-1/2-Inch and 2-Inch Meter Installations

The entry hole through the roof of the vault shall be in accordance with the detail drawings in the Appendix of this chapter. Vaults shall be sealed at all joints and made watertight. Meter vault lids shall be a maximum of 2 inches above the approved final grade.

3.39.03 3-Inch and Larger Meter Installations

The entry hole through the roof of the vault shall be in accordance with the detail drawings in the Appendix of this chapter. Vaults shall be sealed at all joints and made watertight. Meter vault lids shall be a maximum of 2 inches above the approved final grade.

Piping shall be ductile iron, flanged-joint design only. Insulators shall be provided between connections of dissimilar metals.

3.40.00 TESTS

3.40.01 General

The Responsible Party shall disinfect and test all mains and fire lines regardless of existing conditions. This may include repairing existing facilities that must be included in the test and are not capable of holding test pressures. All thrust blocks or other bracing facilities shall be in place at least 48 hours before the initial filling of the line. All tests shall be administered by the City.

3.40.02 Filling and Venting Lines

All existing valves will be operated by the City. The line shall be slowly filled with water and all air expelled from the pipe. Care shall be taken so that all available hydrants (including hydrant gate valves), air valves, and other vents are open during the filling of the line. Where hydrants or other vents are not available in the line, the Responsible Party shall make whatever taps are required for venting purposes. These taps shall be abandoned after testing, the taps removed and the main repaired by the use of a stainless steel repair clamp. The rate of filling the line shall not exceed the venting capacity of the vent. Except when disinfecting the line as indicated below with the chlorination tablet method.

3.40.03 Disinfection

The Responsible Party will be required to chlorinate every new water main installed. This shall be accomplished by one of two methods. In general, the tablet method shall be used. If approved by the City Director of Utilities, the continuous feed method may be used.

The tablet method shall not be used if trench water or foreign material has entered the line. Since preliminary flushing cannot be used with this method, the tablet method shall only be used when scrupulous cleanliness has been executed. Attach dry chlorinating tablets that provide 65% hypochlorite to the top end of each pipe joint with water-soluble permatrix or an adhesive appropriate for potable water during installation as per Section 3.33.02 of these Standards and Specifications. The number of tablets shall be sufficient to produce a dose of 50 mg/l of chlorine. Refer to Table 2 of AWWA C651-92 for the required minimum number of tablets. This table shows the number of tablets for 25 mg/l so the number of tablets needs to be adjusted accordingly. Tablets must also be placed on all hydrants. Introduce water into the pipeline at a rate no greater than 1 ft./sec. and retain the water in the pipeline for a period of 24 hours. The minimum residual chlorine shall be 5 mg/l throughout the entire length.

The continuous feed method is accomplished by introducing water into the line at a constant rate while adding chlorine to maintain a minimum concentration of 50 mg/l. The chlorine must remain in the main for a contact period of not less than 24 hours after which the treated water shall contain no less than 25 mg/l of chlorine throughout the entire length.

This procedure will continue until the minimum requirements of this section are met.

3.40.04 Flushing the Main

The entire line shall be flushed after the specified contact time, and after passing the disinfection test. Such flushing shall continue until the water is clear and meets the chlorine content of the existing line. The entire line, including hydrant leads, branch lines, and dead-end mains shall be flushed. The discharge of flushed water shall be accomplished such that no erosion will occur and with no harm to fish, animals, or plants. Procedures for discharge will be subject to the review of the City.

3.40.05 Pressure Test

After the pipe and appurtenances have been laid, the line has been backfilled, and all field-place concrete has cured in accordance with Section 3.35.00 of these STANDARDS AND SPECIFICATIONS, each valved section, unless otherwise directed by the CITY, shall be subjected to a hydrostatic pressure of not less than 150 PSI or 1.5 times the normal working pressure of the lines, whichever is greater. The test duration shall be not less than one (1) hour. However, in all cases the test pressure shall be 50 percent over existing main pressure in the test

area. Water added to maintain the pressure shall be per AWWA C-600. Allowable leakage shall be calculated according to the following formulas:

Ductile Iron Pipe:

$$\text{and} \quad L = \frac{N D / P}{7400}$$

Polyvinyl Chlorine Pipe:

L = Allowable Leakage in gallons per hour

N = Total number of joints

D = Nominal diameter of pipe in inches

P = The square root of the average test pressure in PSI

When testing against existing closed valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size may be allowed at the discretion of the City.

Each valved section of pipe shall be slowly filled with water and the specified test pressure (measured at the highest point of elevation) shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges, and all necessary apparatus and labor shall be furnished by the Responsible Party. Gauges and measuring devices shall be approved by the City. Before applying the specified test pressure all air shall be expelled from the pipe. Any cracked or defective pipes, fittings, valves, or hydrants discovered in the pressure test shall be removed and replaced by the Responsible Party with sound material.

After all visible leaks have been repaired, the pressure test shall be conducted again. Should testing show a leakage rate in excess of the rates above, the pipeline shall not be accepted. The pipeline shall be repaired, rechlorinated to meet the criteria in Section 3.40.03 of these STANDARDS AND SPECIFICATIONS and retested as described in this section until it meets the test requirements and is accepted by the City.

3.50.00 MATERIALS

3.51.00 GENERAL

Only polyvinyl chloride PVC pipe is approved for water main installations. Any other material proposed must be approved by the City, in writing, prior to construction. Specifications for other materials may be obtained from the City prior to installation. All materials furnished shall be new and undamaged.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Responsible Party of the responsibility for furnishing materials meeting the requirements of these STANDARDS AND SPECIFICATIONS. The City reserves the right to direct or deny the use of certain types of materials in specific circumstances. All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality for the work. The presence of any defects in any materials may constitute sufficient cause for rejection of the pipe or appurtenances. Rejected materials shall be removed from the work site unless otherwise permitted by the City.

3.52.00

PIPE

3.52.01 Polyvinyl Chloride Pipe (PVC)

All PVC pipe 6" diameter or greater shall meet the requirements of AWWA Specification C-900, and shall be Class 150 (SDR 14 or 21). PVC pipe 4" diameter and smaller shall meet the requirements of AWWA Specification Schedule 40, and shall be Class 200.

All pipe shall be suitable for use as a pressure conduit. Provisions must be made for expansion and contraction at each joint with a rubber ring. The bell shall consist of an integral wall section with a solid cross-section rubber ring that meets the requirements of AWWA Specification C-900.

Standard laying lengths shall be twenty feet (20') for all sizes. Random lengths shall not be acceptable.

Each length of pipe shall bear the date manufactured, type, grade, length, manufacturer's name, and NSF seal of approval.

Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.

Solvent cement joints are strictly prohibited.

The manufacturer shall furnish a certified statement that all of the specified tests and inspections have been made and the results thereof comply with the requirements of the applicable standard(s) herein specified. A copy of the certification shall be sent to the City upon request.

3.53.00

FITTINGS

All fittings shall be manufactured in accordance with the following AWWA Standards:

- C-104, "Cement Mortar Lining for Cast-Iron and Ductile Iron Pipe and Fittings for Water"
- C-153, "Gray Iron and Ductile Iron Fittings"
- C-111, "Rubber Gasket Joints for Cast-Iron and Ductile Iron Pressure for Pipe and Fittings"

The following are additional requirements or exceptions to the standards mentioned above:

All fittings shall be furnished with a cement mortar lining of standard thickness as defined in the referenced specifications and given a seal coat of bituminous material. All fittings shall be furnished with mechanical joint, or flanged ends conforming to the referenced specifications and, in addition, the tee-head mechanical joint bolts and hexagon nuts shall be fabricated from a high strength, low alloy steel known in the industry as "Cor-Ten" or approved equal. Mechanical joint anchoring fittings (swivel) as approved by the City, in writing, may also be used.

All fittings shall be 150 PSI pressure rating and shall conform to the dimensions and weights shown in the tables of the referenced specifications. All fittings shall be made from gray iron or ductile iron. The manufacturer shall prepare a certified statement that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the applicable standard(s) herein

specified. A copy of the certification shall be sent to the City upon request.

3.54.00 VALVES

3.54.01 General

All valves shall open left (counterclockwise). All valves shall have a 2-inch-square operating nut. The extension stem shall be mechanically connected to the operating nut. All valves shall have a mechanical joint end and shall be delivered complete with bolts, glands and rubber gaskets.

End connections shall be furnished with all necessary joint materials and shall have full opening flow way of equal diameter to the nominal size of the connecting pipe.

3.54.02 Gate Valves

Gate valves shall be Mueller 2360 Series Resilient Wedge #509. Valves shall be iron body, resilient-seated, gate valves with non-rising bronze stems with design, construction, and pressure rating conforming to AWWA Specifications C-500, with modifications specified herein. Stem seals shall be double "O" ring seals designed so that the seal above the stem collar can be replaced with the valve under pressure and in full open position.

All ferrous internal and external surfaces of the valves shall be coated to a minimum thickness of four mils. The coating shall be a two-part thermosetting epoxy suitable for field overcoating and for touch-up with the same coating material without special surface preparation. The supplier shall furnish detailed performance tests of adhesion, hardness and abrasion resistance of the furnished coatings when requested by the City. The coating shall have a successful record of performance in valves, pipe or other fittings for a minimum of ten years. The double-disk gate valves shall have all bronze internal mechanisms. The resilient seat gate valves shall have external break-off capabilities for over-torquing and positive stop to prevent over compression.

All bolts and nuts used in conjunction with valves shall be stainless steel, "Cor-Ten," or approved equal. All gate valves shall be installed with a valve box meeting the material specifications of Section 3.54.03 of these STANDARDS AND SPECIFICATIONS.

3.54.03 Valve Boxes

Valve box parts shall be Tyler type or approved equal and made of gray cast-iron, buffalo-type with No. 160 large, oval base. A 5-1/4-inch slip-type shaft is required with two (2) or three (3) pieces. Valve boxes shall be considered integral units and shall have at least 6 inches adjustment above and below the specified depth of cover over the pipe. Valve box lids shall be marked with the word "WATER," and shall have a lip or flange extending into the valve box shaft. No slip-type boxes will be allowed. The valve box shall be of a design that will not transmit shock or stress to the valve.

3.55.00 FIRE HYDRANTS

Hydrants shall be Mueller Super Centurion 250 or Kennedy.

3.56.00 BLOW-OFFS

Temporary blow-offs shall be fabricated from a 2" gate valve with drain hole in pipe a minimum of 3'

bellow ground level. The valve shall be iron-bodied bronze mounted with a 2-inch square operating nut complete with valve box. The freeze-proof riser pipe shall be provided with drain pit, and well-greased plug.

The standard required blow-off for 12-inch and larger mains shall be a 6-inch or larger pipe with a gate valve meeting the material requirements of Section 3.54.02 of these STANDARDS AND SPECIFICATION and a manhole meeting the material requirements of Section 4.64.00 of these STANDARDS AND SPECIFICATIONS. This blow-off shall also conform to the detail drawing in the Appendix of this chapter.

3.57.00 MANHOLES

See Section 4.64.00 of these Standards and Specifications.

3.58.00 AIR VACS

Above-ground air vacs may be required by the City. If deemed appropriate to install air vacs information shall be provided by the City.

3.59.00 SERVICE CONNECTIONS

3.59.01 Pipe

Acceptable materials for a service line are seamless copper tube or ductile iron pipe. All service pipes shall conform to one of the following specifications. Plastic pipe is not an acceptable service pipe material.

- (A) Seamless copper tube designated as "Type K" (soft) in the industry shall be used for service lines 3/4-inch through 3 inches.
- (B) PVC pipe conforming to Section 3.52.00 of these STANDARDS AND SPECIFICATIONS shall be used for service lines above 3-inch in size.

3.59.02 Saddles

For all taps requiring saddles, the saddles shall be Romac Style 202 with CI thread in accordance with AWWA C-800, bronze body with bronze double straps or epoxy coated body with painted steel double straps. Saddles for PVC pipe shall be full-support, wide-bearing type.

3.59.03 Curb Stops

Curb stops shall be inverted key angle meter valve Ford BA23-332W, copper by meter coupling with padlock wings and ball valve, or approved equal. 1-1/2 inch and 2 inch curb stops shall have iron pipe or brass fittings.

3.59.04 Tapping Sleeve and Valve

Only epoxy-coated steel tapping sleeves or painted steel sleeves shall be used. Tapping valves shall be double-disc, cast iron body, fully bronze mounted with non-rising stem.

3.59.05 Corporation Stops

All corporation stops shall be Mueller H-15000, Ford FB600, Hayes or approved equal. Stops shall be of all bronze with individually lapped ground keys. Inlet shall be Mueller pipe thread. Outlet shall be for use with copper tubing, flared or compression joint. All corporation stops shall be tested at the factory and shall meet the following minimum physical requirements:

Tensile strength	30,000 PSI minimum
Yield Strength	14,000 PSI minimum
Enlongation in 2 inches	20 percent minimum

3.60.00 ENCASEMENT

3.60.01 Concrete

All concrete shall be a minimum of Class A and shall conform to City standards for Portland cement concrete work as specified in Chapter 7 of these STANDARDS AND SPECIFICATIONS. All concrete encasements shall be a minimum of 6 inches thick from outside of pipe to outside of encasement.

3.60.02 Polyethylene Wrap

Polyethylene encasement material shall be a minimum of 8 mils thick and shall be Scotchrap No. 50 (polyvinyl), or approved equal. All polyethylene encasement material shall be manufactured in accordance with AWWA Standard C-105. The raw materials used to manufacture polyethylene film shall be Type I, Class A, Grade E-1 in accordance with ASTM Standard Designations D-1250.

3.61.00 METERS

3.61.01 General

All water meters shall be provided, installed, and purchased from and by the City. Responsible Party shall be responsible for all trench work including backfill.

3.61.02 Meter Bypass Line

Bypass lines shall contain an independent control valve and shall contain no tees, plugs, or other outlets through which water could be withdrawn.

3.61.03 Meter Check Valves

Swing-check valves shall be manufactured in accordance with AWWA Standard C-508, "Swing-Check Valves for Ordinary Waterworks Service".

3.61.04 Valves for Use with 1-1/2 Inch and 2 Inch Meters

Gate valves 3 inches and smaller to be used with copper service pipe shall be cast iron with Schedule 80 adapters to PVC.

All other gate valves shall conform to Section 3.54.02 of these STANDARDS AND SPECIFICATIONS.

3.61.05 Meter Yokes (Line Setters)

A yoke is a metal pipe frame attached to the inlet and outlet sides of the meter providing support and conveying water to and from the meter. Meter yokes shall conform to Ford model VBHC82W or McDonald model AWWA approved.

3.61.06 Valve and Meter Supports

Meter supports shall be in conformance with the detail drawings in the Appendix of this chapter.

3.61.07 Meter Pits

Residential meter pits shall be installed by the City or approved by the City Utility Department. Approval of the meter pit shall be obtained before purchasing materials.

3.62.00 PRESSURE-REDUCING VALVE

All pressure-reducing valves shall be Clay or approved equal. The valve shall be designed to reduce a high upstream pressure to a constant downstream pressure by way of a pilot control system. The pilot system shall control the main valve that shall be single-seated, hydraulically-operated, diaphragm, and globe-valve type. The valve seats shall be bronze except when subjected to sustained high velocities through the valve, the manufacturer recommends stainless steel seats. An indicator rod or flow tube shall be furnished as an integral part of the valve to show the position of the valve.

The valve shall be cast-iron body. Flanges and covers shall conform to ASTM Standard Designation A-50. Bronze castings or parts of internal trim shall conform to ASTM Standard B-61. All valves shall be furnished with flanged ends and drilled in accordance with ANSI B-16.1 Class 125 specifications. Flanges shall be machined to a flat surface with a serrated finish in accordance with AWWA Standard C-207. The pilot valve for controlling operation of the main valve shall be single-seated, diaphragm-operated, and spring-loaded type. The pilot valve shall be attached to the main valve with piping and isolation valves arranged for easy access in making adjustments and also for its removal from the main valve while the main valve is under pressure. The pilot control system shall be cast bronzed ASTM B-62 with 303 stainless steel trim. The needle valve shall be all bronze and included with the main valve to control the speed of piston travel.

3.63.00 COMBINATION AIR/VACUUM VALVES

At high points in water mains where air can accumulate, provisions shall be made to remove air by means of air relief valves or other means approved by the City. Air valves shall be APCO or Valmatic automatic valves. Air relief valves shall be placed in vaults which allow convenient service of the valve and provide for adequate drainage. Valves shall be cast iron body, 3/4 inch minimum or as sized by air flow requirements, 12" above ground, pointed downward, and covered by #24 mesh.

3.64.00 RESTRAINING SYSTEM

3.64.01 Harness Rods

Harness rods shall be mild steel, ASTM Standard Designation A-36. Hex nuts shall be ASTM Standard Designation A-307, Grade A or B, hexagon heavy series.

3.64.02 Megalug

Mechanical joint restraint can be accomplished by the use of a Megalug restraining system, JCM restraint, or approved equal. Glands shall be manufactured of ductile iron conforming to ASTM A 536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53, latest revision. Twist-off nuts, sized the same as the tee-head bolts, shall be used to insure that the proper torque is applied to the bolts. In no case shall the twist-off bolts be torqued beyond 30 ft. lbs. The mechanical joint restraint device shall have a working pressure of at least 250 PSI, with a minimum safety factor of 2:1.

3.65.00 CONCRETE REINFORCEMENT

All deformed reinforcing bars shall conform to ASTM Standards A-615, Grade 40 or 60, or ASTM Standard A-671, Grade 40 or 60. All welded wire steel fabric shall conform to ASTM Standard A-185.

3.66.00 BACKFLOW PREVENTION DEVICE

Backflow prevention devices shall conform to the requirements of AWWA C 506. Responsible Party shall confirm with City representative before purchasing in order to insure compliance with current Uniform Plumbing Code requirements.

3.67.00 REPAIR CLAMPS

Repair clamps shall be made of stainless steel bands with approved bolts. Gaskets shall be gridded virgin GPR compounded for water service and meeting the requirements of ASTM D 2000-90M 4AA607. Repair clamp design and make shall be submitted to the City for written approval prior to the installation.